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TROPICAL SLOUGHING
PHAGEDŌENA.

On a recent Epidemic of Phagedenic Ulcers
in Mauritius with special reference
to the etiology of the disease.

by

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1.- HISTORICAL SKETCH.

The first observation that has ever been published on Tropical Phagedenism emanates from Dr. Vinson of Réunion, the sister island of Mauritius, who, in the "Union Médicale" of January 1857, described under the name of "Ulcère de Mozambique" certain malignant sores which prevailed in an epidemic form, among coolie emigrants from the coast of Mozambique.

A few years after, 1861, an epidemic ulcer designated as "Ulcère de Guyane" broke out among convicts transported to French Guyana and a similar affection afflicted French soldiers engaged in the Cochin-China expedition. The latter received the name of "Ulcère de Cochin Chine" or "Ulcère Annamite."

Similar ulcers have since been observed at different times in many other tropical regions,

and, according to the countries where they were studied, have been called "Ulcère de Yémen", "Ulcère d'Aden", "Ulcère des Antilles", "Ulcère Malgache", "Ulcère de Sénégal".

In course of time, it came to be established, chiefly by Leroy de Méricourt, Rochard and Chapuis, that these various Ulcers, which were at first believed to be individually peculiar to the regions where they occurred and hence received local designations, were clinically and pathologically identical.

They have been recognised to be the result of the same morbid process and the disease is now universally designated as "Tropical Sloughing Phagedoena" or "Ulcère Phagédénique des Pays chauds".

II.- GEOGRAPHICAL DISTRIBUTION.-

According to Scheube, Tropical Sloughing Phagedoena has been observed in almost all tropical countries of the old and the new World.

So far as Mauritius is concerned, however, there is no positive evidence that typical Phagedenic Ulcers have ever come under notice before.

True it is, that Ulcers have in the Colony always been met with on the lower extremities of patients suffering from ~~E~~nlarged Spleen and ~~A~~ndemia; but these have no tendency to sloughing and are, to all appearances, atonic sores, so frequently associated with the the condition formerly known as Malaria-al Cachexia.

On the other hand, in the pre- antiseptic days, Hospital Gangrene was as common a complication of wounds in Mauritius as elsewhere. Even in 1892, several cases occurred among the unfortunate victims of the Great Cyclone who had remained several hours under the debris of destroyed houses, with their wounds soiled with mud.

But I am not aware that an epidemic affection presenting the typical characters of Tropical Phagedoena was ever observed in Mauritius previous to 1903.

Professor Davidson, who was at one time Visiting and Superintending Surgeon of the Civil Hospital of Mauritius and has considerable experience of our local diseases, does not include Tropical Sloughing Phagedoena, in the enumeration he gives, in his

classical work on "Geographical Pathology," of the diseases which prevail or have prevailed in the Island.

111.- NOTES ON MAURITIUS (GEOGRAPHICAL, METEOROLOGICAL AND NOSOLOGICAL.)

Before proceeding any further with the subject it seems ^{to me} appropriate to give an " aperçu " of the scene of the Epidemic disease under consideration.

Mauritius is an island of volcanic origin, situated in the Indian Ocean, between Latitude ^{20° and} 20°30', S; and between Longitude 57°17', and 57°46'E. It is ^{five} hundred miles to the ~~north~~ east of Madagascar, and 130 miles to the north east of Réunion. Mauritius, Réunion and Rodrigues form the group known as " Mascarenhas Islands "

The Colony which has an ~~area~~ of about 708 square

miles, is densely populated. Its population according to the last Census (1901) is 373,336 inhabitants, divided as follows:

Europeans, whites, mixed	
and coloured	108,415
Africans.....	432
Indians.....	260,980
Chinese.....	3,509
Total.....	373,336.

The majority of the Indian population consist of coolies working on Sugar Estates. Fresh batches of coolies from India are every year introduced into the Island at the expence of the Planters . Every year, likewise, batches of return immigrants are sent back to India.

The summer months are November to April inclusive and the winter months May to October.

The following table, selected from the Annual report for 1904, published by the Director of the Royal Observatory, gives an idea of the Meteorological conditions of the Island :

	Max.	Date.	Min:	Date.	Mean.
Barometric Pressure	30.358	July 26	29.573	Feb. 14	30.055
Temp. of the air.	89.0°	Jan. 10	51.1°	July 13	73.3°

The island is visited by the S.E.Trade winds and occasionally by Cyclones during the months of December to April.

The prevailing diseases are Malaria in all its forms, Dysentery and Tuberculosis. Malaria made its first appearance in the *Colony* in 1865. In 1866, it raged in an epidemic form and made numerous victims. Plague broke out in 1899 and has not yet disappeared. Beriberi is met with ^{only} but among Chinese residents, especially those newly arrived in the Island, or among lascars landed from ships in the Harbour. Leprosy also exists. It affects all classes of the population. There is a special Leper Asylum in Port-Louis, the Capital town.

The tropical parasitic diseases of Mauritius are Bilharziosis, Filariosis and Ankylostomiasis.

-IV- ORIGIN AND MARCH OF THE EPIDEMIC ^{OF} TROPICAL
SLOUGHING PHAGEDOENA.-

The disease broke out in the latter months of 1903 and made its first appearance in the lowlying districts of the Island, chiefly among Indian labourers working on Sugar Estates. Whether or not it was imported by coolie immigrants of recent introduction, it has not been possible to find out.

It soon extended to the other districts and was first observed in Port- Louis in December. There it spread rapidly and during the earlier months of 1904, cases actually poured into the Civil Hospital of the town. *

The epidemic raged with intensity in the first five months of 1904. Then it gradually decreased towards the end of the year, as can be seen from the following table which gives the number of cases treated in the various hospitals and dispensaries of the Colony in 1903 and 1904.

* Port- Louis, the Capital town of Mauritius has a population of 52,740 inhabitants, chiefly Asiatics. It possesses a fine harbour.

The Civil Hospital is the largest Institution of the kind in the Island. It is a general hospital and contains 250 available beds. The average daily number of patients in hospital is between 200 and 210, but in the sickly seasons accommodation has sometimes to be made for as many as 275 patients.

	Civil Hospital	Other hospitals & Dispensaries	Total
1903			
AUGUST	-----	40	40
SEPTEMBER	-----	31	31
October	-----	53	53
NOVEMBER	-----	55	55
DECEMBER	-----	90	90
		<hr/> 269	<hr/> 269
1904.			
JANUARY	28	248	276
FEBRUARY	69	480	549
MARCH	96	524	620
AVRIL	65	310	375
MAY	44	227	271
JUNE	20	124	144
JULY	26	89	115
AUGUST	18	60	78
SEPTEMBER	12	51	63
OCTOBER	7	49	56
NOVEMBER	8	33	41
DECEMBER	5	28	33
	<hr/> 398	<hr/> 2223	<hr/> 2621

THE following additional return from the Civil Hospital shows a slight recrudescence of the disease in the early months of 1905, but this did not last and in December the epidemic appeared to have completely died out.

1905	Civil Hospital
JANUARY	12
FEBRUARY	20
MARCH	18
APRIL	9
MAY	13
JUNE	6
JULY	1
AUGUST	2
SEPTEMBER	5
OCTOBER	1
NOVEMBER	4
DECEMBER	<u>- 0</u> 81

The returns of the other hospitals for 1905 were not ready when I left Mauritius on the 2nd of March last.

It is interesting to note that the disease prevailed with greatest intensity during the hot and rainy months of December to April.

V.-INDIVIDUALS AFFECTED AND REGIONS OF THE BODY INVOLVED.-

At the Civil Hospital, patients suffering from Phagedenic ulcers were nearly all African creoles and Indians walking barefooted. I met with only two or three cases among Chinese in the course of 1904 & 1905. It must be added that the latter very seldom walk barefooted and are in this Colony generally shopkeepers, very few being engaged in agricultural work. I did not observe any case in the educated classes of the population.

Men were more frequently attacked than women and children were rarely so.

The parts of the body involved were almost invariably the lower extremities. The favourite seats of the ulcers were : the dorsum of the foot, the regions of the Malleoli and the Anterior and lateral aspects of the leg. In 100 consecutive cases, the seats of the ulcers were as follows:

Antero-lateral aspect of the leg in 40 cases

Dorsum of the foot -----in 34 "

Malleolar regions -----in 20 "

Ankles -----in 3 "

Heels -----in 3 "
100 "

In two cases, the characteristic lesions were detected in unexpected regions viz: the scalp in a child about 5 years old (vide Photograph 5.) and the interior of the vagina in the vicinity of the Cervix. The latter case was particularly interesting. The patient, a creole

woman of African origin, about 42 years old, was sent to ~~the~~ hospital as a case of Carcinoma of the Cervix. She was anaemic and emaciated, passed an extremely fetid discharge per vaginam, and suffered a good deal. On an examination with both finger and speculum being made, I found an extensive ulceration involving the roof and lateral wall of the vagina on the right side and extending backwards to the Pouch of Douglas. The Cervix was swollen and painful to the touch and showed signs of commencing ulceration. The whole ulcer was covered with sloughs but there was no induration and no marked tendency to bleeding. The diagnosis of Tropical Phagedoena was made and confirmed by microscopical examination.

Under the treatement adopted, presently to be described, the patient recovered in a few weeks and she was discharged from hospital cured.

In two or three cases, the patients who were suffering from ulcers in both legs, were secondarily infected in the hand.

VI.-ASSOCIATION OF TROPICAL PHAGEDOENA WITH OTHER DISEASES-

In the majority of the cases, the disease was associated with other conditions. A small proportion, however, showed no signs of constitutional disorder and

but slight impairment of the general health. That was especially so at the commencement of the Epidemic, but towards the end, only debilitated ^{it} and cachetic individuals presented the characteristic lesions. In the hundred cases mentioned above, observed in March ~~X~~ April 1904, when the epidemic was at its climax, the following conditions coexisted :

Andemia & Splenomegaly in 51 cases

<i>Andemia</i> Bright's disease alone	18	"
<i>Bright's disease</i>	3	"
Bronchitis	3	"
Malarial Fever	2	"
Syphilis	2	"
Gonorrhea	1	case
Influenza	1	"
Eczema	1	"
Diarrhoea	1	"
No appreciable disease	17	cases
	100	"

In many other cases, Scabies was present.-

The disease assumed a particularly severe character in subjects already physically depressed by poverty or some concomittant debilitating illness.

VII.--DESCRIPTION OF THE PHAGEDENIC LESIONS AS
OBSERVED AT THE CIVIL HOSPITAL

The ulcers occurred either single or in groups of two, three, or more, affecting usually one leg but not unfrequently both.

According to the accounts given by the patients, the disease started either as a small sore following slight injuries, such as abrasions, etc; or as a sort of boil which came on without any previous traumatism. In the latter case, a bleb was formed which, on bursting, left an ulcerative surface. I have seen a few cases of this affection in its incipient stage, and, contrarily to the opinion of Corre and Le Dantec, I agree with Bechtinger and Manson that the phagedenic process may develop in a previously sound and ^uninjured skin. Lombard, whose description of "Ulcère de Mozambique" is quoted by **Davidson** in his Treatise on Geographical Pathology, appears to share the same view. "The sore," he says, "commences by a small "bleb filled with yellow serosity which is succeeded " by a circular ulcer which enlarges day by day." I admit, however, that in most of the cases that came under my notice, the disease had set in as a complication to a preexisting sore or injury. In many cases, the stating point was a scratch caused by cane leaves or the thorns of a shrub known in the Island as " Vieilles Filles" .

In whatever way the ulcers began, they rapidly extended in all directions and became covered with a layer of thick, creamy, dirty-looking and fetid pus in which shreds of sloughs were imbedded. The sloughing process varied in degree. In the milder cases, which fortunately constituted the predominating type of the epidemic, the skin and subcutaneous tissue only underwent gradual sloughing over more or less extensive surfaces, the deep tissues being left unaffected. The ulcers thus formed were excavated and were characterised by raised rounded or irregular edges. Photographs 1 to 3 are very good illustrations of cases of this description.

Their surfaces freely discharged pus of the nature described above. The skin was frequently undermined to a considerable extent above and below the sore. As already pointed out by Manson, the neighbourhood of the ulcer was always more or less inflamed and oedematous, especially if the patient had been obliged to walk much, as was generally the case. The pain was in some cases so intense as to cause insomnia. In others, little or no pain was complained of. - In a severer form, tendons and muscles were exposed and subsequently underwent partial or total sloughing. In Photograph 4 the tendons of the common extensor of the toes are seen exposed. In the severest form, in addition to the destruction of the soft tissues of the limb, there was necrosis of underlying bone. In a few instances, the

whole foot and leg were in a gangrenous condition. Extreme cases like these, invariably the result of carelessness and neglect, were fortunately of very exceptional occurrence.

The Tendo Achillis and part of the Os Calcis had to be excised in one case and the greater part of the Tibialis Anticus in two cases.

Necrosed pieces were also removed from the body of the Tibia, from the Malleoli and from the ^{bones} of the Tarsus. One case in this respect was interesting. Patient, an Indian lad of 18, agricultural labourer, was admitted to Hospital on the 20th. of May 1904 with a large sloughing ulcer extending over the front of the left leg. He was also suffering from Chronic Malaria characterised by Anaemia, Hypertrophy of the Spleen and periodical attacks of Fever. There was an abundant discharge of pus not only from the sore itself, but also from a large cavity, as ascertained by probing, which led on to its undermined edge from above. On the following day, I made, under Chloroform, a free vertical incision into this cavity which lay over the external aspect of the Tibia, when all the muscles attached to the bone were found gangrenous and the bone itself completely denuded of its periosteum along a considerable part of its length.

All gangrenous tissues were removed with scissors and sharp spoon and carbolic fomentations were applied for some days. On the 28th, the leg presented on the anterior aspect of its lower two thirds, a granulating surface which covered the Fibula and extended underneath the Tibia through the interosseous space to the inner part of the leg, leaving the lower two thirds of the necrosed bone, with the exception of the lower extremity, completely exposed. Excision of the exposed Tibia was considered necessary, but the patient refused to submit to the operation and applied for his discharge.

On the 18th. of October, i.e. four and a half months after, he came back to Hospital in the following condition:

The granulating tissue had now completely cicatrised and the necrosed Tibia from the Tuberosity to a little above the Malleolus, was still lying bare over the cicatrised surface but was getting loose at its upper part.

The patient, whose general health had considerably improved, consented this time to the excision and a piece of Tibial shaft, 8 inches long, was removed. He was discharged from Hospital with a crutch on the 2d of December, completely cured. I have unfortunately not been able to see him since to ascertain what degree of strength the operated leg, practically deprived of its tibia, would have recovered in time.

In two cases, the destruction of the tissues of the leg and foot was so extensive that Amputation above the knee had to be resorted to. Both patients rapidly recovered after the operation. Photographs 6 and 7 show the leg of one of these patients. In a third case, of the same nature, the patient who was admitted with high Fever and delirium was too weak to allow of an amputation being made with any chance of success. He died soon after admission. That was the only fatal case we had at the Civil Hospital.

In the severe cases, the pain was distressing the constitutional disturbances considerable and Fever of the Hectic type almost always present. ^{Yet,} It is surprising how the disease proved amenable to treatment and how few were the fatal cases.

When once healthy granulations had appeared on the ulcer, the cicatrization was rapid, even over extensive surfaces. In no case did I find it necessary to have recourse to skin-grafting according to Thiersh's method.

VIII.- TREATMENT.--

At the outset of the Epidemic, I tried various antiseptics locally, one after the other:-compresses of sublimate lotion (1 in 2000) or formol solution (1 in 400) prolonged immersion in weak carbolic or Lysol lotion, or

or in permanganate solution (1 in 4000), dusting with Iodoform etc. but the results obtained were not satisfactory.

The treatment which eventually proved most successful in my hands was the application of pure Carbolic acid with a lint or cotton mop, as recommended by Manson, frequently repeated until sound granulations were obtained. After each carbolic cauterisation, the ulcers were dressed with powdered Camphor. Under this treatment, superficial sloughing sores, even extensive and of the worst appearance, were in the course of a few days converted into healthy granulating ulcers which healed rapidly. Many patients however, who left hospital too soon, had to come back shortly after, the sloughing process having recurred in their sores.

The application of pure Carbolic acid to the phagedenic ulcer is not painful and does not necessitate the use of ^{an} anaesthetic. It gives rise to a slight burning sensation which is quickly followed by relief, the pain inherent to the ulcer ceasing sometimes entirely after two or three applications. I have in many cases applied the carbolic every day for several days and an excellent gauge of the comparative painlessness of the operation was the willingness of the

indian patient, who does not bear the least pain, to submit to it. In applying the Carbolic Acid, care must be taken to protect the edges of the sore so as to prevent the acid flowing over the neighbouring skin. I have seen severe Eczema break ^{out} up after the unaffected skin had been ^{so} irritated.

Equally good results were obtained by the application of Phenol-Camphor, an oily fluid resulting from the trituration of equal parts of powdered Camphor and pure Carbolic crystals. This preparation has the advantage over pure Carbolic of being less irritating. The last 30 or 40 cases under my care were treated with Phenol Camphor.

When the deeper tissues were involved, the gangrenous muscles and necrosed bones were removed under Chloroform and the resulting surface freely scraped. Then Carbolic fomentations were applied until this surface was completely cleaned and covered with healthy ^h looking granulations. Finally, Camphor dressing was used.

It is interesting to note that I never saw a case of Carboluria resulting from this free and constant use of Carbolic acid.

I need hardly say that, apart from the local treatment, too much attention cannot be paid to the constitutional condition of the patient. The best food available was given and the coexisting diseases received

due consideration. Tonics were freely administered for the Cachectic state present in a large proportion of the cases. Easton's Syrup proved most valuable as such.

IX.- ETIOLOGY.-

If one goes over the works which have since Vinson's report been published on Tropical Phagedenism, one finds quite a number of widely different views expressed on the pathological nature and etiology of the disease.

It will be remembered that the first observers regarded the "Ulcère de Mozambique, Ulcère de Cochinchine etc, as so many local affections peculiar to the tropical regions where they were first studied.

Subsequently, other investigators came to the conclusion that the ulcers described under so many different names were clinically and pathologically identical and belonged to a single morbid entity which received the name of "Ulcère Phagédénique des Pays chauds."

This designation, which has up till now been preserved, was, I need hardly say, given on the *understanding* that the disease was essentially a

tropical one.

Such, however, was not the opinion of Corre, a well-known authority on tropical diseases, who believed the so called Phagedenic ulcers of warm countries to be identical with Phagedenism of other climatic regions. "Le Phagedinisme," he says, "ne diffère pas entre les tropiques de ce qu'il est dans les autres zones climatiques. Il est seulement plus fréquent et plus redoutable dans les pays chauds parce que les causes qui le déterminent sont plus nombreuses et plus intenses."

And he concludes his chapter on the subject in the following words : "Nous persistons donc à croire qu'il n'y a pas à étudier une espèce particulière d'ulcère dans les pays chauds, mais seulement l'ulcération et le Phagédénisme, quand ils sont dominés entre les Tropiques par les divers états de la détérioration organique et les conditions multiples d'infectivité locale au sein du milieu." (Traité Clinique des maladies des pays chauds. Edition 1887.)

In this opinion, Scheube and Roux entirely concur.

But whether or not identical with Phagede^h~~e~~

nism of temperate climates, Tropical Phagedoena is doubtless caused by a micro-organism. On this point all modern writers agree, although opinions differ as to the pathogenic organism concerned.

At least three organisms have been described as having been discovered in the sloughing ulcers affecting natives of certain tropical regions.

In 1884, Le Dantec, having occasion to observe an epidemic of phagedenic ulcers on Arab convicts in French Guyana, examined microscopically coloured preparations of discharges from the ulcers and found in considerable quantity certain Bacilli which he describes as follows:

"Ces bacilles étaient droits, immobiles, "
"quelquefois recourbés quand ils atteignent leur plus "
"grande longueur; ils mesuraient en moyenne de 7 à "
"12 μ . Une piqûre faite à l'Index me démontra que le "
"microbe n'envahissait pas la circulation générale."
"Mes préparations furent soumises à Mr Roux qui con-"
"clut en ces termes: "Il est très probable que le Ba-"
"cille prédominant dans tous les cas d'Ulcère est la "
"cause de la maladie; en tout cas, en attendant que "
"la preuve soit faite par l'inoculation en culture "

"pure, il est important de signaler la présence de ce"
"Bacille!"

Le Dantec's Bacilli did not stain by Gram's method and could not be cultivated on the ordinary nutritive media. Experimental inoculations on rabbits, dogs and guinea pigs gave negative results.

Le Dantec's discovery was confirmed in 1885 by Clarac in Martinique and by Petit at Mayotte and in 1890 by Boinet in Tonkin.

In 1895, Vincent found in cases of Hospital Gangrene occurring among Arab return immigrants from Madagascar, a Bacillus which presented the following characters: It was a rectilinear, sometimes curved, non-motile Bacillus, not shorter than 3 to 4 μ . It did not stain by Gram's method and could not be cultivated in ordinary media. The inoculation of the exudate gave negative results with normal rabbits but positive ones with weak and cachetic animals.

The same Bacillus was subsequently detected by Coyon in ^atypical case of Hospital Gangrene occurring in one of the Paris Hospitals, so that Vincent's Bacillus is now regarded by many as the cause of Hospital Gangrene.

Now, Le Dantec contends that his Bacillus

closely resembles Vincent's Bacillus and concludes in the identity of Tropical Sloughing Phagedoena, with the Hospital Gangrene of Temperate Climates.

In 1887, Blaise found in Phagedenic Ulcers observed by him in Algeria long Bacilli, some straight and some curved, which he could not successfully cultivate; he believed that Hospital Gangrene and Tropical Phagedoena could exist side by side in the same subject, the former complicating the latter. (*Gazette hebdomadaire de Médecine et de Chirurgie*, Octobre, 10, 1897.)

At exactly the same time (Oct. 1897,) Dr. Milton Crendiropoulo, who was for many years in charge of the Lazaret of Camaran, and who had in that capacity occasion to see a great number of cases of cases of Phagedenic Ulcers among the Arab natives, published in the "*Annales de l'Institut Pasteur*" (vol. XI. No 10, page 784.), the result of his long observations. Crendiropoulo regularly found in the sores he examined a Bacillus which he described as follows:

"C'est un petit batonnet isolé, rarement
"réuni par deux, aux extrémités arrondies, deux ou"
"trois fois plus long que large. Il est mobile et"

"présente au milieu un étranglement apparent surtout"
"dans les cultures jeunes. Je ne l'ai jamais vu spo-"
"ruler. Il prend très bien les couleurs de l'aniline,"
"mais la méthode de Gram et ses dérivés le décolorent."
"Sur les préparations colorées on rencontre souvent "
"la forme en navette." Crendiropoulo successfully cul-
tivated his Bacillus in several culture media: Bouil-
lon, Agar-Agar, Gelatine and Potatoes. "Dans les mi-
lieux liquides", he adds, "les éléments sont plus "
"volumineux, d'une grandeur inégale, et doués d'un "
"mouvement plus vif. Dans les vieilles cultures, le Ba-"
"cille a une tendance à former des chaînettes assez "
"longues quelquefois pour occuper tout le champ du "
"microscope, enchevêtrées, légèrement mobiles et "
"articulées."

Inoculation of rabbits and pigeons with
this Bacillus proved the micro-organism to be patho-
genic for these animals. In strong inoculations,
death ensued more or less rapidly from blood-poiso-
ning. Weaker inoculations set up phagedenic sores
at the seat of inoculation. - Such sores
cicatrised in from 15 to 20 days. In intraperito-
neal injections, Crendiropoulo recovered his Bacil-
lus from all internal organs.

Crendiropoulo concludes that his Bacillus

is the chief, if not the only pathogenic agent in Tropical Phagedoena, at least in the country where he studied the disease.

To sum up, the different views which have been hitherto expressed respecting the nature and etiology of Tropical Phagedoena may be tabulated as follows:

1°.- A special complication of sores and wounds peculiar to the regions where it occurred (Ulcère de Mozambique, Ulcère de Cochin-Chine etc.)

2°.-Phagedinism affecting sores and wounds and peculiar to tropical countries in general.(Ulcère phagédénique des Pays chauds.)

3°.-Phagedinism in tropical countries identical with atonic phagedenic ulcers in temperate regions.(Carre, Roux, Scheube.)

4°.-A disease probably caused by a long, non-motile Bacillus (Le Dantec.)

5°.- Tropical Phagedenism identical with Hospital Gangrene, on the assumption that Le Dantec's Bacillus is identical with Vincent's Bacillus, which is likewise non-motile (Le Dantec.)

6°.- A disease caused by a long Bacillus distinct from Hospital Gangrene with which however it may be complicated.(Blaise, Brault.)

7°.-A disease probably caused by a long and motile Bacillus which could be successfully cultivated (Crendiropoulo)

None of the various conclusions and views which in the above sketch I have endeavoured to bring^{up} to date, appears to have been universally accepted, for we find in Scheube's recent Treatise on diseases of warm countries, the following opinion expressed:"It can hardly be doubted that micro-organisms, specific or various, are the cause of Phagedoena. It seems, however, very questionably if in the Bacilli found by various investigators (Le Dantec, Petit, *Boinet*, Blaise, Crendiropoulo) not reckoning the ordinary suppurative and putrefactive fungi, the actual cause of the disease has been discovered, or these organisms are only present as secondary invaders."

Manson shares the same opinion when he states that the etiology of Tropical Phagedoena is doubtless depending on the proliferation in the af-

fectured tissues of some micro-organism "not yet satisfactorily separated."

On the other hand, Wurtz and Thiroux in their work "Diagnostic et séméiologie des Maladies Tropicales", published in 1905, seem to question the existence of Tropical Sloughing Phagedoena as a separate disease when they ask: "L'entité ulcère phagédénique des pays chauds sera-t-elle un jour démembrée et disparaîtra-t-elle pour être rattachée en partie à la Syphilis et en partie au Paludisme, de même que le bouton d'Orient semble pour certains auteurs pouvoir dans un avenir assez rapproché être rattaché définitivement au Kala-azar? Il est en tout cas logique de penser actuellement que la chose est possible."

The Etiology of Tropical Sloughing Phagedoena was in the stage of uncertainty shown by the above diversity of views, when the Epidemic of Mauritius broke out. Abundant opportunities were afforded^{me} at the Civil Hospital for investigation and I was led to make bacteriological researches with a view to elucidating this unsettled question. In these researches, I was assisted by Mr E. Maya, the Pharmacist of the Hospital, who prepared the

[Paragraph to be inserted after line 18. P. 28]

- *. They were actively motile. - In many preparations there were such crowds of them, that their individual movements were impeded and only a stirring mass of entangled Bacilli was seen in the field of the Microscope. -

culture media and helped me in making the cultures and in collecting and staining slides. The following is a summary of the results obtained.

The examination of the purulent discharges and sloughs revealed the presence of ordinary pyogenic organisms and saprophytes and otherwise showed nothing particular.

After the ulcer had been rid of all discharges and thoroughly cleaned by prolonged washing with sterilised water, the sides of the sores were gently squeezed and films were made with saneous exudation which oozed from the surface. In every case thus examined, we found in considerable quantity and in pure cultures, Bacilli which presented the following characters:

They were straight or slightly curved, with rounded or somewhat tapering extremities. Their length was from three to five times their width.* They were easily stained with the basic aniline dyes, but not uniformly so, two or more clear spaces being left unstained. They were decolorised by Gram's method. In the presence of the great motility of the Bacillus, attempts were made to stain the cilia after ^{Von}Ermengen's method, but failed to give

a most diff.
process

the desired result.

The Bacillus was found in vast numbers either alone or associated with a very fine spirillum which stained very lightly and was decolor^{is}ed by Grams' method.

I had kept a great number of excellent preparations made at the time when the Epidemic was at its worst, i. e. from February to May 1904. Unfortunately they grew faint with time and fresh preparations, equally good, had to be made with the stray cases met with at the end of 1905.

Six of these slides accompany this thesis. The Bacillus was successfully cultivated in the ordinary media viz:- Peptone broth, Agar-agar and Gelatine, and the results obtained were similar to those described by Crendiropoulo in his interesting work on "Ul-cère de Yémen", in the "Annales ~~de l'~~ Institut Pasteur. Like this observer, I found in the liquid media the Bacilli more voluminous and more motile; I likewise found in the old cultures the tendency to form chains and *the* diminished motility.

The Bacillus was distinctly aerobic, anaerobic cultures could not be obtained.

In a word, all the experimental cultures

(expect that on potato) made by

-35-
Crendiropoulo were repeated and identical results were obtained.

Morphologically and biologically therefore, the micro-organism found in the Phagedenic ulcers which prevailed in Mauritius answers exactly the description of the Bacillus found by Crendiropoulo in similar cases at Camaran. It differed essentially from Vincent's Bacillus of Hospital Gangrene, (and from that of Le Dantec), by its motility, the latter being incapable of spontaneous movement.

Unfortunately, the clinical laboratory attached to the Civil Hospital, (the only bacteriological laboratory in the Island*), being not fitted up for experimental inoculations on animals, that part of Crendiropoulo's investigations could not be confirmed.

Judging however from the morphological and biological characters of the Bacillus above described, I have no doubt that it is in every respect identical with Crendiropoulo's Bacillus.

Two facts however ^{which} were brought to light

* A scheme is now under consideration for the creation in the Colony of a proper Bacteriological Institute to be under the management of a Bacteriologist from Europe.--

in the preparations I examined are not mentioned by Crendiropoulo viz:-The occasional association of the Bacillus with a Spirillum and the presence of clear spaces in the stained preparations. In October last, I wrote to Dr Crendiropoulo on the subject and forwarded to him at the same time a copy of the Civil Hospital Annual Report for 1904, in which I had given an account of the reseaches carried on ^{at the Civil Hospital} Tropical Sloughing Phagedoena. I received from him the following letter which I here transcribe "in extenso" because it contains many interesting points in connection with the subject.

" Sanitary Maritime and
Quarantine Council of
Egypt.

—
Alexandria, le 13 Décembre 1905.

" Cher et honoré confrère,

" Je m'empresse de répondre à votre
honorée et de vous remercier pour le gracieux envoi
que vous avez eu l'obligeance de me faire.

" Le Bacille que vous avez si bien
décrit parait en effet identique au mien. Les espaces

"clairs que vous avez signalés, je les ai aussi re-
"marqués et je rapporte le fait dans mon mémoire.
"Dans le premier paragraphe du Chapitre "Morphologie
"et Biologie" je dis textuellement cette phrase: "Sur
"les préparations colorées on rencontre souvent la
"forme en navette"(shuttle shaped).

I must confess that I did not understand
the "forme en navette" to imply the presence of
clear spaces.

"Quant aux spirilles, je les ai quelque-
"fois rencontrés comme il appert de mes notes que je
"viens de revoir, mais j'ai eu le tort de ne pas y
"attacher une grande importance. La symbiose de mon
"Bacille avec le Staphylocoque a attiré davantage
"mon attention, étant de beaucoup la plus fréquente"

In this latter respect, the researches car-
ried on ^{at} the Civil Hospital do not coincide with tho-
se of Dr Crendiropoulo. I never noticed in the nu-
merous preparations I examined the presence of the
Staphylococcus in association with the Bacillus I
have described. This difference in our observations
may arise from a difference in the methods of

obtaining the films. As stated above, the preparations examined by me consisted in the sanæous exudation obtained by gently squeezing the ulcer from side to side after it had been completely rid of the sloughs and purulent discharges and had been cleansed by prolonged washing with sterilised water. The examination of the superficial discharges and sloughs showed Streptococci, Staphylococci and micro-organisms of putrefaction.

Dr Crendiropoulo's letter continues thus:

"Le Dr Ferid Bey de Constantinople,
" dans une de ses missions à Djeddah a entrepris l'étude de l'Ulcère Phagédénique et a trouvé le même
" bacille dans ^{tous} les cas. Son travail n'a pas été publié, mais il cite le fait dans un rapport adressé
" au Conseil supérieur de l'Empire Ottoman".

"Je me permettrai d'attirer votre attention
" sur un autre point. C'est de savoir si dans les
" ulcères où l'on rencontre le Bacille en question,
" on trouve aussi l'Helicosoma Tropicum de Wright.-
" Il vous sera aisé de le faire exergant dans un
" pays où cette maladie est fréquente et vous pourrez éclairer ici en grande partie la question de
" la spécificité de l'Ulcère Tropical, d'autant plus

" que Laver^{an}eau, Mesnil et Benlinger ont trouvé le
" Piroplasma Donovan, qui ressemble beaucoup au
" parasite de Wright, dans le bouton d'Alep.

" Agréez, cher et honoré confrère,
" l'assurance de ma parfaite considération."

Dr M. Crendiropoulo. "

This letter reached me when the Epidemic was practically over. I could not therefore prosecute the researches on the lines advised by Dr Crendiropoulo.

I may finally mention that when Schaudinn's recent discovery of the Spirochoete pallida came to be known to the medical world, the idea struck me that cases where a spirillum was found associated with Crendiropoulo's Bacillus might possibly be cases of Tropical Sloughing Phagedoena grafted on Syphilis. To clear this point, I obtained from typical primary chancres preparations which after staining showed the Spirochoete in large number.

After a comparative study of the morphological characters of the two micro-organisms, I came to the conclusion that they were distinct. Schaudinn's spirillum appears to me to be finer, to have more pointed extremities and to be much more wavy than the spirillum found in Phagedenic sores. -

X.- CONCLUSIONS.-

1°.-The Epidemic ulcers which prevailed in Mauritius in 1903, 1904 and 1905 were clinically identical with the Ulcers originally described as *Ulcères de Mozambique, de Cochinchine, de Yémen* etc and now included under the generic term of Tropical Sloughing Phagedoena.

2°.- The disease affected almost solely people walking barefooted viz:-Indians and African creoles.

3°.- It prevailed with greatest intensity in the hot and rainy months.

4°.- In the majority of the cases, the phagedœnic process invaded preexisting sores or wounds, sometimes of a trifling nature. In a few cases, however, there was positively no history of traumatism.

5°.- In the majority of the cases, likewise patients affected were already depressed and ~~weakened~~^{*predisposing*} by some constitutional disease. The chief cause in this respect appeared to be Malarial Cachexia.

6°.- In a few cases, at the outset of the Epidemic, there was no coexisting constitutional diseases and the patient's general condition was

satisfactory. In such cases, the ulcers had invariably a mild character ^{and} were rapidly cured.

7°.- The disease presented itself under two different forms:-a mild one and a severe one, the former being the predominating type in this Epidemic.

The disease

8°.- ~~It~~ ^{It} proved very amenable to treatment as out of 852 cases treated in the hospitals of the Colony in 1904 only two had a fatal termination.

9°.- The local treatment which was found most successful at the Civil Hospital ^{in the mild and moderately severe cases.} was repeated applications of pure Carbolic Acid or Phenol Camphor. *The severest cases necessitated Surgical interference.*

10°.- A motile Bacillus, morphologically and biologically identical with that described by Crendiropoulo in 1897 in "Ulcère de Yémen," was present in all cases in the exudation from the cleaned ulcer.

11°.- The constancy of the presence of this Bacillus in very large number and frequently alone in the sores tends to indicate that it is really the micro-organism concerned in the etiology of the Sloughing Phagedoena which prevailed in Mauritius in the last three years.

12°.- The great motility of this Bacillus, as contrasted with the absence of motility in the case of Vincent's Bacillus, would indicate that Tropical Sloughing Phagedoena is distinct from the Hospital Gangrene of Temperate Zones.

13°.- The fact that only barefooted individuals were attacked and the lower extremities usually affected would show that the usual habitat of the pathogenic organism concerned was probably the soil.

14°.- The contagiousness of the disease was not clearly demonstrated, at least to my knowledge, in this epidemic.

Instances of secondary infection in the same person were met with but ~~there~~^{was} no evidence of the disease having spread by contact among members of the same family.

In the interesting case referred to above, where the typical phagedenic ulcer was detected in the Vagina, the mode of infection could not be traced for obvious reasons, the patient being unmarried.



I



II



III



IV



V



VI



VII. (Seq in V enlarged.)

B I B L I O G R A P H Y

LIST OF WORKS CONSULTED OR REFERRED TO.-

- BLAISE :- L' Ulcère Phagédénique des pays chauds
en Algérie (Gazette hebdomadaire de
Médecine et de Chirurgie Oct.1897)
- CORRE :- Traité clinique des Maladies des pays
chauds (1887)
- CRENDIROPOULO :- Note sur un Bacille pathogène pour
l'Ulcère de Yémen (Ulcère des Pays
Chauds): Annales de l'Institut
Pasteur, 1897.XI.N° 10,p: 784.-
- DAVIDSON :- Geographical Pathology (1892)
- LE DANTEC :- Pathologie exotique (1905)
- MANSON :- Tropical Diseases.
- ROCHARD :- DE l'Ulcère de Cochinchine (Archives
générales de Médecine, 1862)
- ROUX :- Traité pratique des Maladies des Pays Chauds
- SCHEUBE :- The diseases of warm countries (Transla-
ted by ~~Carr~~ *Carr*)
- VINSON :- Ulcère de Mozambique (Union Médicale,
JANUARY 1857)
- WURTZ and THIROUX :- Diagnostic et Séméiologie des
Maladies Tropicales (1905)